

**What is claimed is:**

1     1.    A method for fabricating a metal structure,  
2    comprising:

3            providing a semiconductor substrate with a conductor  
4                thereon;

5            forming an insulating layer overlying the  
6                semiconductor substrate;

7            forming a hole in the insulating layer exposing the  
8                conductor;

9            substantially filling the hole with a conductive  
10               material as a conductive plug;

11           forming a silicon carbon-containing film;

12           forming a low dielectric constant layer;

13           forming a trench in the low dielectric constant  
14               layer and the silicon carbon-containing film;

15           forming a lining layer on the trench; and

16           substantially filling the trench with copper or  
17               copper alloy electrically connecting the  
18               conductive plug.

1           2.    The method as claimed in claim 1, wherein the  
2    conductive material comprises tungsten.

1           3.    The method as claimed in claim 1, wherein the  
2    conductor comprises metal silicide.

1           4.    The method as claimed in claim 1, wherein the  
2    semiconductor substrate comprises silicon.

1           5.    The method as claimed in claim 1, wherein the  
2    semiconductor substrate comprises silicon germanium.

1           6. The method as claimed in claim 1, wherein the  
2 conductor is composed of doped semiconductor,  
3 polysilicon, metal, metal compound or a combination  
4 thereof.

1           7. The method as claimed in claim 1, wherein the  
2 insulating layer comprises undoped silicate glass (USG).

1           8. The method as claimed in claim 1, wherein the  
2 thickness of the silicon carbon-containing film is less  
3 than 500 Å.

1           9. The method as claimed in claim 1, wherein the  
2 silicon carbon-containing film is silicon carbide(SiC).

1           10. The method as claimed in claim 1, wherein the  
2 carbon content of the silicon carbon-containing film  
3 exceeds 20%.

1           11. The method as claimed in claim 1, wherein the  
2 dielectric constant (k) of the low dielectric constant  
3 layer is less than 3.0.

1           12. The method as claimed in claim 1, wherein the  
2 low dielectric constant layer is formed by chemical vapor  
3 deposition (CVD) and/or Spin-On method.

1           13. The method as claimed in claim 1, wherein the  
2 low dielectric constant layer comprises inorganic film  
3 and/or organic film.

1           14. The method as claimed in claim 1, wherein the  
2 width of the hole is less than 950Å.

1           15. The method as claimed in claim 1, wherein the  
2 width of the trench is less than 1300Å.

1           16. The method as claimed in claim 1, wherein the  
2 lining layer comprises Ta and/or TaN.

1           17. The method as claimed in claim 1, wherein the  
2 copper or copper alloy is formed by chemical vapor  
3 deposition (CVD) and/or physical vapor deposition (PVD).

4           18. The method as claimed in claim 1, wherein the  
5 copper or copper alloy is formed by plating.

1           19. A metal structure, comprising:     ✓  
2 a semiconductor substrate with a conductor thereon;  
3 an insulating layer overlying the semiconductor  
4 substrate having a hole therein exposing the  
5 conductor;  
6 a conductive plug substantially filling the hole and  
7 electrically connecting the underlying  
8 conductor;  
9 a silicon carbon-containing film overlying the  
10 insulating layer and the conductive plug;  
11 a low dielectric constant layer overlying the  
12 silicon carbon-containing film;  
13 a trench in the low dielectric constant layer and  
14 the silicon carbon-containing film; and  
15 a copper or copper alloy conductor substantially  
16 filling the trench, electrically connecting the  
17 conductive plug.

1           20. The structure as claimed in claim 19, wherein  
2 the conductive plug comprises tungsten.

1           21. The structure as claimed in claim 19, wherein  
2 the conductor comprises metal silicide.

1           22. The structure as claimed in claim 19, wherein  
2 the semiconductor substrate comprises silicon germanium.

1           23. The structure as claimed in claim 19, wherein  
2 the conductor is composed of doped semiconductor,  
3 polysilicon, metal, metal compound or a combination  
4 thereof.

1           24. The structure as claimed in claim 19, wherein  
2 the insulating layer comprises undoped silicate glass  
3 (USG).

1           25. The structure as claimed in claim 19, wherein  
2 the thickness of the silicon carbon-containing film is  
3 less than 500 Å.

1           26. The structure as claimed in claim 19, wherein  
2 the silicon carbon-containing film comprises silicon  
3 carbide (SiC).

1           27. The structure as claimed in claim 19, wherein  
2 the carbon content of the silicon carbon-containing film  
3 exceeds 20%.

1           28. The structure as claimed in claim 19, wherein  
2 the dielectric constant (k) of the low dielectric  
3 constant layer is less than 3.0.

1           29. The structure as claimed in claim 19, wherein  
2 the low dielectric constant layer is formed by chemical  
3 vapor deposition (CVD) and/or Spin-On method.

1           30. The structure as claimed in claim 19, wherein  
2 the low dielectric constant layer comprises inorganic  
3 film and/or organic film.

1           31. The structure as claimed in claim 19, wherein  
2 the width of the hole is less than 950Å.

1           32. The structure as claimed in claim 19, wherein  
2 the width of the trench is less than 1300Å.

1           33. The structure as claimed in claim 19, wherein  
2 the lining layer comprises Ta and/or TaN.

1           34. A metal structure, comprising:

2 a semiconductor substrate with a nickel silicide  
3 thereon;

4 an insulating layer overlying the semiconductor  
5 substrate having a hole therein exposing the  
6 conductor;

7 a conductive plug substantially filling the hole and  
8 electrically connecting the underlying  
9 conductor;

10 a silicon carbon-containing film overlying the  
11 insulating layer and the conductive plug;

12 a low dielectric constant layer overlying the  
13 silicon carbon-containing film;

14 a trench in the low dielectric constant layer and  
15 the silicon carbon-containing film; and

16           a copper or copper alloy conductor substantially  
17           filling the trench, electrically connecting the  
18           conductive plug.

1           35    The structure as claimed in claim 34, wherein  
2           the conductive plug comprises tungsten.

1           36.   The structure as claimed in claim 34, wherein  
2           the thickness of the silicon carbon-containing film is  
3           less than 500 Å.

1           37.   The structure as claimed in claim 34, wherein  
2           the carbon content of the silicon carbon-containing film  
3           exceeds 20%.

1           38.   The structure as claimed in claim 34, wherein  
2           the dielectric constant (k) of the low dielectric  
3           constant layer is less than 3.0.

1           39.   The structure as claimed in claim 34, wherein  
2           the width of the hole is less than 950Å.

1           40.   The structure as claimed in claim 34, wherein  
2           the width of the trench is less than 1300Å.

1           41.   The structure as claimed in claim 34, wherein  
2           the lining layer comprises Ta and/or TaN.